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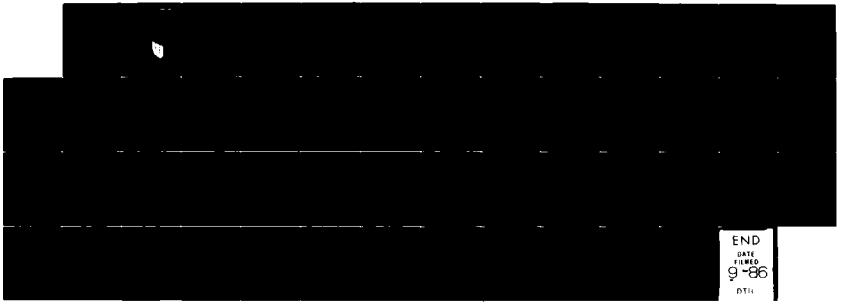

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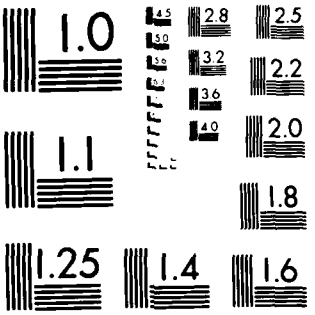


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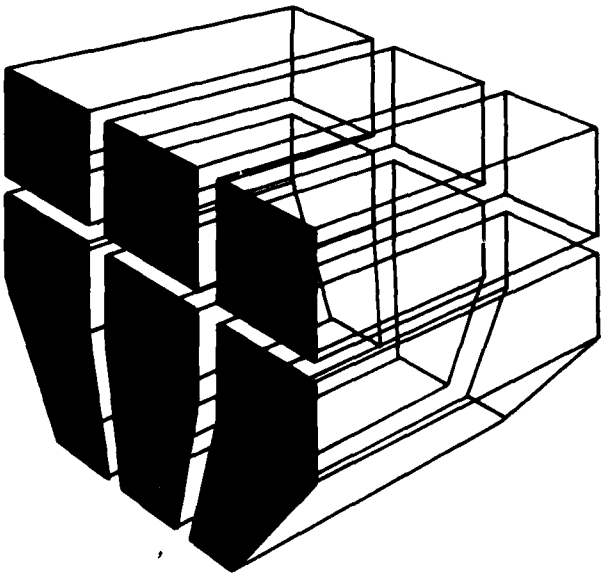
INTERIM REPORT P-86/10
July 1986
Combat Engineer Command and Control System



# Function Requirements for Combat Engineer Command and Control in the Maneuver Control System

by
Charles E. Herring, Jr.
Kathryn A. Mills



The Army Command and Control System (ACCS) is being developed to provide automated information transmission and analysis to support the commander's decision-making process. The tactical portion of the ACCS is divided into five functional areas, each represented by an automated subsystem. Combat engineers are included in the Maneuver Control System.

The U.S. Army Engineer School has developed an operational and organizational plan (OOP) for the Engineer Command and Control System (ECCS). Based on the OOP, other documents, and pilot testing by the U.S. Army Construction Engineering Research Laboratory, functional requirements are identified and prioritized for development. This provides the basis for the initial design of the objective ECCS software capability.

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The Army Command and Control System (ACCS) is being developed to provide automated information transmission and analysis to support the commander's decision-making process. The tactical portion of the ACCS is divided into five functional areas, each represented by an automated subsystem. Combat engineers are included in the Maneuver Control System.

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## FOREWORD

This work was performed by the U.S. Army Construction Engineering Research Laboratory (USA-CERL) for the Assistant Chief of Engineers, Office of the Chief of Engineers (OCE), under Project 4A162731AT41, "Military Facilities Engineering Technology"; Task Area E, "Military Engineering"; Work Unit 053, "Combat Engineer Command and Control System." The OCE Technical Monitor was Austin Owen, DAEN-ZCM.

The work was done by the USA-CERL Facility Systems Division (FS). E. A. Lotz is Chief, FS.

COL Paul J. Theuer is Commander and Director of USA-CERL, and Dr. L. R. Shaffer is Technical Director.


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CONTENTS

# FUNCTION REQUIREMENTS FOR COMBAT ENGINEER COMMAND AND CONTROL IN THE MANEUVER CONTROL SYSTEM

## 1 INTRODUCTION

### Background

The Army is developing the Army Command and Control System (ACCS), an automated control system supporting military commanders from foxhole through corps echelons on the battlefield. The Army Command and Control Master Plan ($AC^2MP$) describes in detail the objective architecture of the ACCS and provides an implementation plan that includes responsibilities and milestones for combat and materiel developers.[1]

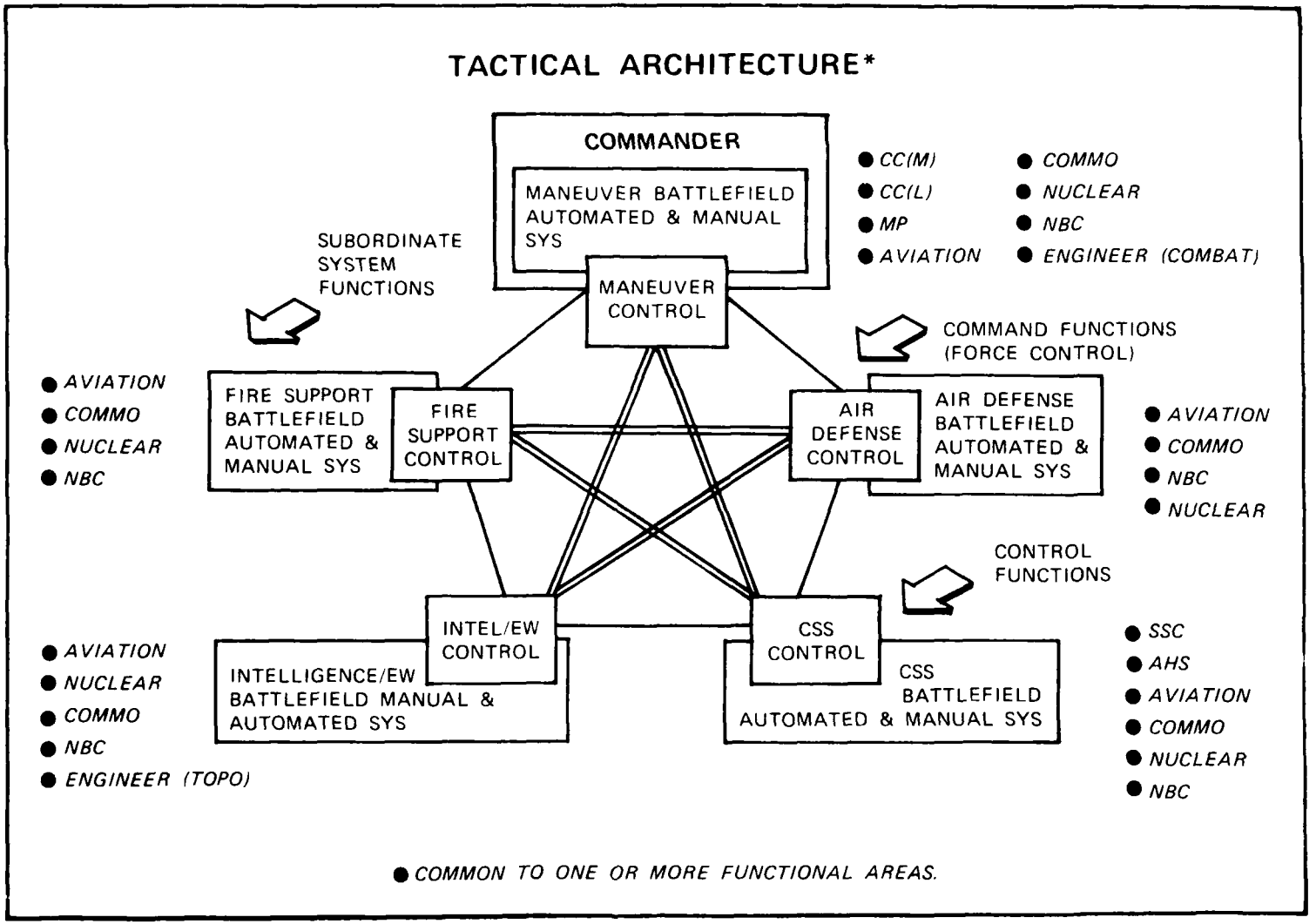
The architecture for the tactical portion of ACCS is known as the "Command and Control Subordinate System ($CCS^2$)" concept (Figure 1). This architecture divides the battlefield into five functional areas: maneuver control, fire support, combat service support, air defense, and intelligence/electronic warfare. At each tactical level of command (corps through battalion) the five functional areas will be represented by an automated subsystem: Maneuver Control System (MCS), Advanced Field Artillery Tactical Data System (AFATDS), Combat Service Support Control System (CSSCS), Air Defense Command and Control System (ADCCS), and All Source Analysis System (ASAS), respectively. Because combat engineers support the maneuver commander, the engineer function is included in MCS as a subordinate system. (Appendix A lists the distribution of MCS nondevelopmental items [NDI] to engineers.)

MCS is an automated data processing network designed to support armor, infantry, and aviation force level commanders in the decision-making process. The Combined Arms Combat Development Activity (CACDA) is the proponent and developer of MCS. The main hardware components of MCS are: Tactical Computer System (TCS), Tactical Computer Terminal (TCT), Tactical Computer Processor (TCP), Analyst Console (AC), and Battalion Terminal (BT). (Appendix B describes these devices.) The TCS and TCT are fully militarized and located primarily at corps and division levels. The TCP, AC, and BT are NDI and are located at corps through battalion levels.

It is the U.S. Army Engineer School's (USAES) responsibility to develop an operational and organizational plan (OOP) for the Engineer Command and Control System. This OOP will be included as an annex to the MCS OOP written by CACDA.

The USAES asked the U.S. Army Construction Engineering Research Laboratory (USA-CERL) to help write the OOP for the Engineer Command and Control System. This OOP describes the Engineer Command and Control System (ECCS). The ECCS is a tactical command and control system for engineer units, corps and below.

[1] *Army Command and Control Automation Master Plan With Mission Area Analysis (u)* (CACDA, December 1982 update).




*Source: CACDA AC$^2$MP update

**Figure 1. Tactical architecture for the Army Command and Control System.**

## Purpose

The purpose of this work is to (1) analyze engineer command and control missions and responsibilities to determine functional capabilities required for the objective ECCS, (2) describe these functional capabilities, and (3) prioritize their development for an OOP. This work serves as framework and initial design for the objective system's software.

## Approach

An extensive literature search of Army command and control documents formed the basis of this work. The information is drawn heavily from the Engineer Studies Center (ESC) Automated Combat Engineer Operations and Planning System (ACEOPS) analysis work.[2] USA-CERL developed pilot-test software to determine the functional requirements for engineer command and control and participated in command and control working groups at the Combined Arms Center (CAC), Fort Leavenworth, KS, and at USAES.

## Scope

This report focuses on functional requirements for the objective ECCS component of MCS as specified in the OOP of May 1985.

## Mode of Technology Transfer

The software developed by USA-CERL has been added to the Command and Control Microcomputer User Group library. The ECCS OOP was delivered to CACDA in July 1985.

[2] *Automated Combat Engineer Operations and Planning System (ACEOPS)*, USAESC-R-84-7 (U.S. Army Engineer Studies Center, November 1984).

## 2 AUTOMATION REQUIREMENTS AND PRIORITIES

It was decided at the Engineer Command and Control Automation Master Plan (ENCAMP) meeting in May 1985 that ECCS would consist of MCS-NDI hardware and software coupled with engineer-specific software. (Appendix C lists the resolutions reached at ENCAMP.) This chapter describes ECCS software requirements within this environment. Figure 2 shows USAES's conceptual design of the objective ECCS.

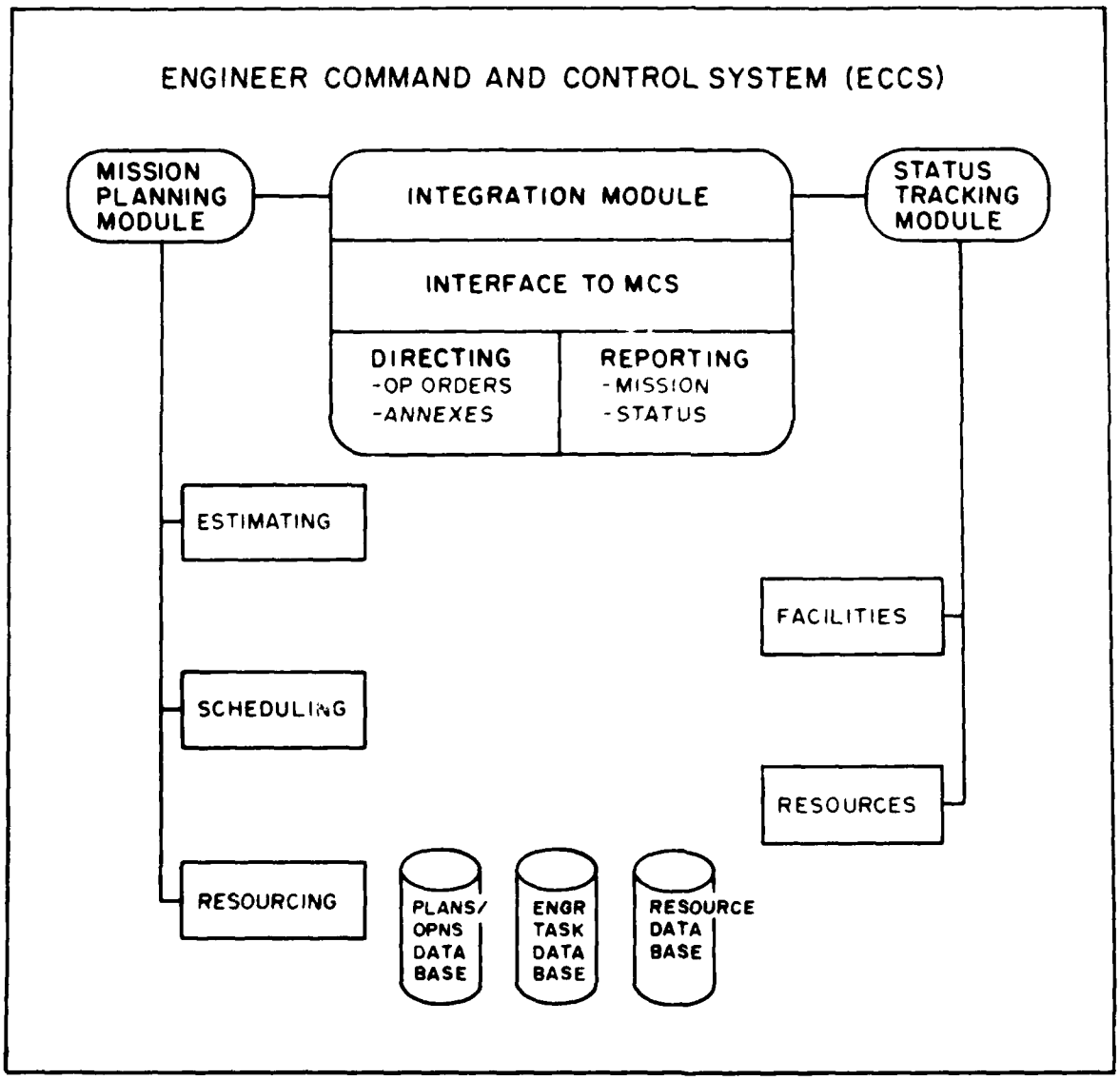



**Figure 2. Engineer Command and Control System (ECCS) structure.**

The engineer elements of command control that will participate in the MCS and utilize the ECCS are:

- Combat engineer brigade, corps
  -Corps engineer
  -Assistant corps engineer
- Combat engineer group
- Combat engineer battalion, divisional
  -Division engineer
  -Assistant division engineer
  -Brigade engineer
- Company commander
- Platoon leader

The basic missions of these elements are (1) command and control of assigned and attached units and coordination of their activities and (2) provision of an engineer staff section to assigned parent unit headquarters.

The elements' capabilities include:

- Staff planning and operational supervision of all assigned and attached units
- Planning and supervising operations pertaining to topographic and terrain intelligence
- Providing the engineer staff to a supported headquarters
- Supervising and coordinating the planning, preparation, and firing of atomic demolitions munitions
- Representing engineer staff at the Tactical Operations Center (TOC)
- Commanding units that perform mobility, countermobility, and survivability missions in support of the combined arms team

The command and control functional requirements of ECCS software are divided into the four areas (listed by priority for development):

- Engineer status reporting/assessment
- Planning and analysis tools
- Decision support graphics
- Miscellaneous

As of late FY85, the first two areas had progressed to the stage of pilot-testing in the field.

**Engineer Status Reporting/Assessment**

The USAES's concept design for the ECCS is shown at Figure 2. The Status Tracking Module represents the status reporting and assessment function that is local to the ECCS. The information is maintained at the ECCS nodes and transmitted from engineer platoon through engineer battalion and brigade engineer. The Integration Module represents the gateway to MCS and the other ACCS nodes. It is through this gateway that ECCS extracts locally needed information from the other ACCS nodes and passes information out into the ACCS network. MCS provides for reports that are common to all users, e.g., nuclear/biological/chemical (NBC) reports. This chapter discusses the engineer-specific reports required by ECCS.

The first priority for engineer command and control automation is to develop a status reporting and assessment system. Engineers from corps through battalion require engineer unique and specific information to manage the engineer effort. The system must, as a minimum, provide for timely transmission of a basic set of engineer reports from the engineer company, through the engineer chain of command, to corps. Additional requirements are the ability to produce consolidated reports from the basic engineer reports for resource accounting, obstacle group status, and material requirements. A data-base application is required to produce these consolidated management reports.

The basic reports required are outlined below. This outline does not claim to represent the exact and final design contents of each report; moreover, research must be done to determine if other reports should be included, such as those required by NATO Standardization Agreement (STANAG) 2036 (Doctrine and Procedures in the Technique of Land Minefield Laying and Recording), STANAG 2096 (Reporting Engineer Information in the Field), and other host nations nations and joint/combined headquarters. The Force level Information Requirement Plan (FLIRP) data elements also must be accommodated. Work must be done to standardize these reports as much as possible throughout the engineer community because developing software for each unit's standard operating procedure (SOP) is infeasible. Furthermore, the reports must conform to STANAG and Joint Interoperability of Tactical Command and Control Systems (JINTACS) formatting procedures.

*Required Reports*

The system must provide for the Obstacle Report (A through E), Engineer Report, Engineer Mission Coordination Sheet, Engineer Spot Report, River-Crossing Report, and free text messages. Appendix D describes the format and data elements of these reports.

Obstacle Report. This report transmits the status of individual obstacles and obstacle systems from lower to higher headquarters. The report has five formats, lettered A through E.

(A) Obstacle Progress Report (OBSREP-A): the basic obstacle status feeder report prepared by squad or platoon to transmit information on a single obstacle.

(B) Belt Progress Report (OBSREP-B): maintained by brigade engineer and based on OBSREP-A. OBSREP-B reports the status of an obstacle belt. The report consists of OBSREP-A reports grouped by obstacle belt.

(C) Zone Progress Report (OBSREP-C): maintained by the division engineer and derived from OBSREP-B. It translates the specific data from OBSREP-B into an analysis of obstacle completion (by type) for each of the belts. Also groups belts into zones.

(D) Corps Obstacle Plan Report (OBSREP-D): maintained at corps level and derived from OBSREP-C. It is a tabular summary of obstacle zone completion across the corps, consisting of zone/belt name, percentage complete, percentage effective, and projected date-time group (DTG) of completion.

(E) Enemy Obstacle Report (OBSREP-E): maintained by brigade engineer to record the status of enemy obstacles as they are encountered by friendly forces, or friendly obstacles that fall into enemy hands.

Engineer Report (ENGREP). ENGREP is the engineer commander's assessment of the engineer situation in his/her area of responsibility. The report consists of four parts:

1. Assessment of the engineer situation: free text describing the commander's assessment of the past and/or next 24 hr of engineer activity.

2. Atomic demolitions munitions (ADM) site preparation: formatted report giving the status of ADM drilling operations.

3. Equipment status: formatted report giving the status of critical engineer equipment.

4. Engineer data sheet: critical information on the status of personnel, equipment and logistical assets. It can be expanded to include any item considered critical to engineer operations.

Engineer Mission Coordination Sheet (MISSREP). MISSREP is a standard formatted report that coordinates engineer missions. It is designed to transfer specific details about an engineer mission between operational levels.

Engineer Spot Report (ENGSPOTREP). ENGSPOTREP is a free text report that allows engineer commanders and their staffs to keep superiors fully informed of events having engineer operational importance.

River-Crossing Report. This is a formatted operational report for coordinating tactical river-crossing missions.

Free Text Messages. These messages transmit frag orders, operations orders, and similar unstructured format information not used by the data base.

*Data Base Management*

Timely, accurate transmission of engineer reports is vital to engineer command and control, and effective management requires that this data be transformed into useful information. A data base management system is required for this task. Appendix E describes the MCS data base management capability. Appendix F gives the physical location of the Commander's Critical Information Requirements (CCIR) that pertain to engineers.

The principal function of the data base is to provide the ability to produce summary reports compiled from the reports described above. These summary reports are as follows:

1. Obstacle Belt Status: lists each obstacle in the belt and gives percentage complete and percentage effective for each belt. The rollup report is based on the OBSREP-A.

2. Obstacle Zone Status: lists each belt in the zone and gives zone percentage complete and percentage effective. This rollup report is also based on OBSREP-A.

3. River-Crossing Status: allows user to look through the river-crossing reports and produce reports by data-base query.

4. Enemy Obstacle Status: allows user to look through enemy obstacle reports and produce reports by data-base query.

5. Engineer Data Sheet: produces a summary report based on rollup of engineer data sheet section of Engineer Report. User can query for rollup at any unit level. This must take into account the engineer order of battle.

6. Equipment Status: produces a summary report based on rollup of equipment status section of Engineer Report. User can query for rollup at any unit level. This must take into account the engineer order of battle.

7. Class I, II, and V Reports: produces summary reports based on rollup of logistical assets from Engineer Report. User can query for rollup at any unit level. This must take into account the engineer order of battle.

*Company and Platoon Reporting Requirements*

To make the battalion-through-corps reporting system function at near real-time, engineer companies and platoons must be able to feed the reporting system with information in digital format. The ECCS OOP calls for a portable microcomputer at company level and a hand-held digital message device at platoon. (Appendix B describes these devices.)

The company system must be able to receive and consolidate reports from platoon and to send reports in a format compatible with the brigade engineer system and other MCS nodes located at the supported maneuver unit.

The company system must be able to send the following reports to the brigade engineer: Obstacle Report OBSREP-A, Engineer Report, Engineer Mission Coordination Sheet, Engineer Spot Report, River-Crossing Report, and free text messages. (Appendix D gives the format and data elements for these reports; Appendix G contains a complete listing of engineer reports for company and platoon.)

The platoon's digital message device must be programmed with preformatted messages compatible with the company system. The platoon system must be able to send the following reports to the company: Obstacle Report OBSREP-A, Engineer Report, Engineer Mission Coordination Sheet, Engineer Spot Report, River-Crossing Report, and free text messages (Appendix D).

**Planning and Analysis Tools**

A major responsibility of the engineer commander and staff is to plan how engineering effort will be used in developing tactical plans. The procedure for planning this effort is called the "engineer estimate." The purpose of the engineer estimate is to assess the engineer effort required to support an operation and provide a basis for the task organization of engineer resources. The results of this plan becomes the engineer input to the division and brigade operations order. The division engineer, assistant division engineer (ADE), brigade engineer and the S3 of the divisional battalion are responsible for this plan.

To produce a viable plan of action, the engineer must conduct a mission and task analysis, which is complex and varied and requires numerous calculations. The completeness of this analysis is constrained by the short amount of time available in a tactical situation. The ECCS must assist the engineer in this analysis.

The Mission Planning Module, as shown in Figure 2, provides a general schematic for the objective ECCS software planning and analysis tools.

USA-CERL has developed a pilot version of the engineer estimate part of the Mission Planning Module called the "Combat Engineer Mission Management Module ($CEM^3$)." The program provides for two levels of planning--engineer staff estimate and mission analysis--and contains the algorithms to calculate many common combat engineering tasks.[3] (Appendix H lists the engineer task/resource data base elements.) The user also may define new tasks. At the estimate level, the program tracks squad hours, blade hours, and certain logistic items. The user selects the tasks to be accomplished in the mission and the program calculates the total resources needed and, based on the resources available, determines the time-resource constraints. The user can do what-if analyses by varying mission parameters such as duration and troop efficiency.

Once the initial estimate has been completed, the user can make decisions on engineer task organization and command relationship. The program can be used to do detailed mission analysis in developing a higher resolution of resource requirements. The mission analysis part of the program tracks resources by type, e.g., D7 dozer, M21 Anti-tank mines. In the mission analysis phase of planning, tasks are assigned to specific engineer units. The user can do detailed resource analyses and what-if exercises. The program can produce a bill of materials for the mission by unit and as a total.

The user can place priorities on the mission tasks using the program's two-level priority system. The first level of priority is by area: mobility, countermobility, survivability, and user-defined. Within the area priority, the user can further prioritize the tasks as vital, essential, critical, and necessary. Placing priorities on the tasks is the first step in scheduling the mission. USA-CERL Technical Report P-86/05 describes the operation of this prototype system in greater detail.

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[3]Charles E. Herring, Jr., *Combat Engineer Mission Management Module ($CEM^3$), Volume I: User's Manual for Version 86.0*, Technical Report P-86/05 (U.S. Army Construction Engineering Research Laboratory [USA-CERL], 1986); Jennifer S. Young, Charles E. Herring, Jr., and CPT Roger A. Gerber, *Combat Engineer Mission Management Module ($CEM^3$), Volume II: Engineer Task Algorithm Reference Guide for Version 86.0*, Technical Report P-86/05 (USA-CERL, 1986).

In the objective ECCS, where decisions can be based on near real-time data, the scheduling of engineer tasks can take into consideration the resource status of units. Further research is needed to define specifications for the task-scheduling algorithm. This is not a simple "critical path method" problem; the tasks are constrained more by conditions such as location of unit with respect to task and location of supplies than by network precedence. This application should allow the user to see the progress of engineer work 24, 48, and 72 hr into the operation. The user also must be able to perform what-if analyses.

The planning and scheduling programs should help generate the operations order by drawing information such as the task organization, task list, and target lists from the mission data files. Part of the operations order can be formatted automatically based on the mission information. The program should provide an operations order editor. It is also possible that the reporting system described above could update the mission network directly, thus giving insight into the mission's most current status.

Additional engineer-specific planning and analysis tools that should be developed to complete the Mission Planning Module include those for:

- River crossing
- Obstacle material hauling and distribution
- Evaluating material stockage for distribution and location
- Bridge calculations
- Road network haul capacity
- Terrain analysis for obstacle systems, weapons positions, line of sight, and similar information
- Mission assignment

Other applications of importance to planners include:

- Maintenance and loss projections
- Supply projections
- Class III bulk projections
- Class V bulk projections
- Road movement table
- Time-distance calculations for vehicles
- Personnel strength projections
- Threat analysis.

### Decision Support Graphics

The engineer commander and staff need to display data-base queries in graphical format. This capability is important for assessing engineer status, briefing the maneuver commander on the status of engineer work, and displaying obstacle systems.

The critical application of this capability for the engineer is to display the position and status of obstacles to the maneuver commander. Other applications include display of the engineer order of battle, MSR display and status, movement orders, and operations orders overlays.

The MCS uses color decision support graphics as required to meet the engineers' needs. The information presented is divided into three categories: operations, battle resources, and intelligence. Each category is presented in three separate levels; each level presented processes an increasing amount of detail. Table 1 shows the matrix of MCS decision support graphics presentation levels and Appendix I describes these levels in detail.

### Miscellaneous

It is assumed that the MCS-NDI will supply standard applications packages such as word-processing, user-defined data base, graphics, and spreadsheet. It is also possible that battlefield simulations, expert systems, artificial intelligence, and other advanced tools may be used on the MCS-NDI as command aids.

**Table 1**

**MCS Decision Support Graphics***

| | Operations | Battle Resources | Intelligence |
|---|---|---|---|
| Level 1 | Tactical situation | Overall status | All avenues of approach/advance |
| Level 2 | Tactical situation<br>One echelon up<br>Two echelons down | Overall status of MSC: two echelons down | Individual avenues approach/advance |
| Level 3 | Tactical situation with overlays | Overall status by type | Individual avenues approach/advance |

*Source: *Operational and Organizational Plan for the Maneuver Control System Volume I* (Draft) (CACDA, May 1985).

## 3 CONCLUSION

ECCS is a subordinate system to the MCS that provides for combat engineer command and control from engineer platoon through corps. This report describes the functional requirements of ECCS as Mission Planning, Status Tracking and MCS Integration. The requirements for each of these have been outlined. USA-CERL is working with USAES to further define these requirements and to develop prototype software. Field evaluation of these prototypes will be used to generate specifications for the actual ECCS implementation.

## APPENDIX A:

## MCS-NDI DISTRIBUTION PLAN FOR COMBAT ENGINEERS

Devices will be issued to engineer locations as follows:*

1. Corps echelon--

   Corps G-3 operations main CP: 1 AC for ACE

   Corps engineer brigade operations: TCP with 1 AC (AC for Bde S-2)

2. Division echelon--

   Division G-3 operations main CP: AC for ADE

   Division engineer battalion operations: BT.

   Brigade engineer: AC.

3. Separate brigades and regiments--

   Brigade/regimental engineer section: BT.

*This hardware distribution is taken from the *Operational and Organizational Plan for the Maneuver Control System, Vol 1* (Draft) (CACDA, May 1985).

## APPENDIX B:

## COMMAND AND CONTROL SYSTEMS

### Analyst Console

The Analyst Console (AC) is a Tactical Computer System (TCS) display-keyboard module used in combination with a TCS line printer-plotter. The AC has stand-alone capability, but is used primarily in conjunction with the Tactical Computer Processor (TCP) as a "peripheral device" during tactical operations.

The AC is a small, general-purpose computer for use by the coordinating and special staff officers at the corps, division, and brigade force levels. The AC can be used in developing plans for employing particular weapon systems, units, and equipment, and for supervising particular areas of combat support and combat service support.

The AC must be able to access information from the host computer and other computers through the host; conversely, it must be able to receive taskings and messages from other workstations (without interfering with the processing being performed), its host computer, and other computers.

Specifications have not yet been published; however, the following operational capabilities are expected:

- Power: no additional power as a remote terminal; commercial power as a stand-alone
- Communication: wire or cable connection to host up to 100 m of local area network
- Peripherals: plasma screen, keyboard, and line printer-plotter
- Weight: 15 lb
- Size: 6 cu ft
- Survivability: same as the TCP.

### Battalion Terminal

The Battalion Terminal (BT), also known as the Battalion Level Device, is an automated command and control device for armor, cavalry, and aviation battalions. As such, it must be capable of mounted operations in the vehicles associated with those organizations in all current proposed force structures. Although not required by military specifications, it will be a hardened device.

Specifications for the BT have not been published; however, a list of operational requirements has:

- Memory: at least 512K bytes, full memory retention, overflow storage, expandable

- Power: 28-VDC vehicle power, commercially available power
- Communication: PJH data distribution system, use of existing channels and encryption devices, use of two different systems concurrently, at least two ports
- Peripherals: screen 25 lines by 80 characters, 1:50,000 scale graphics of 10 km by 5 km area, printer that prints anything, screen displays without special paper or ink, keyboard ASCII and numeric with variable function keys.
- Weight: 50 lb (including power and communications modules)
- Size: 3 cu ft
- Survivability: survive blast, fragmentation, smoke, electromagnetic pulse, direct and indirect conventional fire, -25°F to +125°F, mud, rain, sleet, snow, hail, electrical storms, high winds, NBC contamination; air-, land-, and water-transportable as loose cargo
- Supportability: green suit, MOPP IV, for extended shifts (12 hr) under severe environmental conditions.

**Digital Communications Terminal**

The Digital Communications Terminal (DCT) is a lightweight hand-held communications message processor that provides the user with point-to-point and netted communications over a variety of military radios and secure equipment. The DCT is operator-interactive with an LED display and key entry for composing and reading out messages. It provides user prompting to aid in message composition. The ability to compose, edit, display and process communications messages is provided through a stored program and a microprocessor. To augment and speed the composition of messages, a map display is provided to assist in positional data entry. This map is scaled from a field map and can identify terrain and tactical data.

The DCT can receive and transmit multiple messages over tactical nets with operator alerting and automatic storage of specified messages. These messages can be in fixed or variable format. The message processor performs all tasks of format composition, address coding, error control, and error checking, as well as net protocol. The operator can specify message data rate, addresses of receiving agencies, and keying time.

The DCT provides interaction with the operator via the LED display with a transparent overlaid 54-position switch entry. Using this direct input/readout feature, the function of each switch can be redefined by operator menu selection under program control. The operator can compose from a full alphanumeric keyboard on selected and formatted messages. To augment this capability and decrease positional entry, direct graphic capability is provided with touch or cursor selection and entry of individual map positions.

Specifications for the DCT are:

- Memory: 128K RAM

- Power: battery, vehicle power with adapter, external 115-VAC with adapter
- Communications: one channel, two-way
- Peripherals: accommodate various input/output devices via a communications port
- Survivability military specifications.
- Weight: 5 lb
- Size: 8.8 in. long by 6.9 in. wide by 1.6 in. high.

**Grid Compass Computer**

The GRID Compass, an NDI of the $MCS^2$, is a commercial off-the-shelf lap-top microcomputer. As a part of $MCS^2$, GRID provides timely information processing and rapid communication between functional areas, while being extremely portable and survivable.

This type of device is specified in the ECCS OOP for the company-level computer as follows:

- CPU: Intel 8086 16-bit main processor, Intel 8087 80-bit arithmetic coprocessor
- Memory: up to 512K bytes RAM, up to 512K bytes ROM, 384K bytes bubble memory as secondary storage
- Power: 90 to 140-V or 160 to 280-V, user selectable; 47 to 66 Hz, 60 W
- Communication: optional built-in modem, RS232-C and RS422 serial interface, IEEE-488 general-purpose interface bus parallel
- Peripherals: keyboard, electroluminescent flat-panel screen
- Survivability: rugged magnesium case, operating temperature 50 to 104°F, operates at up to 10,000 ft altitude, 5 to 95 percent relative noncondensing humidity
- Weight: 10 lb
- Size: 15 in. long by 11.5 in. wide by 2 in. high.

**Tactical Computer Processor**

The Tactical Computer Processor (TCP) also is an NDI of MCS. The TCP is a Hewlett Packard 9920U system and is not mil-spec. It will be found at brigade, division, and corps levels. The MCS-NDI is scheduled for fielding in 1988. Specifications are:

- CPU: Motorola 68000 16-bit processor

- Memory: primary--1 megabyte RAM; secondary--55 megabyte hard disk
- Power: ACV to DCV inverter, frequency converter, AVIONICS power converter, TOPAS uninterrupted power source
- Communications: two channels, interface--Singer programmable commo unit
- Peripherals: CRT, keyboard, printer-plotter, disk drive, graphics table
- Weight: 732 lb
- Size: 58 cu ft.

**Tactical Computer System**

The Tactical Computer System (TCS) is a militarized general-purpose data-processing, display and communications system designed to facilitate the collection, generation, review, analysis, and distribution of tactical information. The TCS is found primarily at the division and corps levels.

The TCS has a modular design consisting of a display-keyboard module, line printer module, magnetic bubble recorder-reproducer, digital processor, power supply, digital input-output interface module, tape transports, digital-voice communications interface module, field-wire junction box, and remote monitoring junction box.

The TCS's operational software is packaged into 12 major modules: operating system, communications processing program, print program, display program, diagnostic program, data base management system, message filing, graphics program, operations validation program, data initialization program, text edit program, and message logging.

Fielding is scheduled to begin during 1986. Specifications are:

- CPU: ROLM 1666B 16-bit processor
- Memory: primary--512K bytes RAM expandable to 1 megabyte; secondary--8-megabyte bubble storage
- Power: 28 VDC or converts 50/60/400 Hz to 28 VDC
- Communication: 12 channels
- Peripherals: plasma display, keyboard, printer-plotter, tape drive, disk drive, flexible disk drive
- Weight: 972 lb
- Size: 41 cu ft.

**Tactical Computer Terminal**

The Tactical Computer Terminal (TCT) is a fully militarized, compact, general-purpose data-processing display and communications terminal. It is intended for Army

field use in a variety of highly mobile tactical applications. TCT is compatible with existing military communications equipment. It can overlay standard topographical map segments with standard symbols, which can be transmitted by wire or radio. Hard copy also can be obtained. The TCT stores information to be used later for modification or update. It is found primarily at the brigade and division levels.

TCT design is modular in both hardware and software. Hardware includes: display-keyboard processor, line printer-plotter, recorder-reproducer flexible disk, power supply, power distribution module, tape transports, magnetic tape recorder-reproducer, and cable assembly junction box.

The modular software components are the operating system, communications processing program, print program, display program, diagnostic program, data base management system, message filing, graphics program, operations validation program, data initialization program, text edit program, and message logging.

Fielding is scheduled to begin during 1986. Specifications are:

- CPU: Motorola 68000 16-bit processor
- Memory: primary--512K bytes, secondary--600-K byte disk
- Power: 28 VDC or converts 50/60/500 Hz to 28 VDC
- Communication: two channels
- Peripherals: plasma display, line printer-plotter, flexible disk, magnetic tape
- Weight: 519 lb
- Size: 22 cu ft.

## APPENDIX C:

## RESOLUTIONS, ENCAMP, 13-14 MAY 1985

1. MCS:

a. The Engineer Command and Control Automation System (ECCS) should use MCS hardware.

b. Our first objective must be the approval of our O&O Plan.

c. While mid- and long-term implementation of ECCS must be considered, USAES will first concentrate on Phase I:

- Resolution: Cbt Bn HQ, Div and Corps, Cbt Hvy Bn HQ, Eng Group HQ, Corps Bde HQ
- Mission Subarea: Cbt--Bde forward and CFA; Cbt Hvy--Div rear and RBA
- Battlefield functions: Mobility, Survivability, Countermobility, General Engineering.

Responsibility to determine and analyze functions automated in Phase I will be accomplished by DOTD with assistance of DME and DCA, under DCD guidance as program proponent.

d. The objective language for all software is ADA. Near-term programs should be developed to be consistent with this objective.

e. Any function or product that needs a data base must have the data source identified, including mission and capability.

2. TOPO: Omitted.

3. TIMEFRAMES AND OBJECTIVES:

a. Timeframes:

(1) Near-term--current year + 2 (FAA)

(2) Midterm--POM years

(3) Farterm--beyond POM (LRRDP)

b. Objectives:

(1) Fielding of MCS-NDI to engineers, near-term.

(2) Fielding of ECCS, Phase I (engineer MCS software), near-term.

(3) Complete MICROFIX fielding, near-term.

(4) Phase II, development and fielding, midterm.

APPENDIX D:

## DATA ELEMENTS OF ENGINEER REPORTS FOR CORPS AND BELOW

Data elements in the reports are based on Appendix B of ESC report *ACEOPS* (USA-ESC-R-84-7), which is based on "Standardization of Engineer Reporting Within V Corps," Letter (Headquarters, V Corps, 21 April 1983). They are also based on work by USA-CERL in the development of a reporting system for the 7th Engineer Brigade and are, therefore, partly based on its SOP. They are further based on STANAG 2096, *Reporting Engineer Information in the Field*, 4th ed., 1st Draft (21 December 1982).

Note: all reports must contain security classification, unit designation, precedence, and date-time group (DTG). They also must conform to STANAG and JINTACS message formatting rules.

### Obstacle Report

Transmits the status of individual obstacles and obstacle systems from lower to higher headquarters. The report has five formats lettered A through E.

(A) Obstacle Progress Report (OBSREP-A): the basic obstacle status feeder report prepared by squad or platoon to transmit information on a single obstacle. Information includes:

1. Target number
2. Type code
3. Location
4. DTG of current status--where status is:
   - initiated
   - installed
   - turned over
   - executed
5. DTG anticipated to be installed
6. Total manhours scheduled to complete
7. Manhours actually worked.

(B) Belt Progress Report (OBSREP-B): maintained by brigade engineer and based on OBSREP-A. Reports status of an obstacle subsystem, with an OBSREP-B maintained for each obstacle subsystem. The report consists of OBSREP-A reports grouped by obstacle subsystem. Each obstacle in the report has the following lines:

1. Target number

2. Type code

3. Location

4. DTG initiated

5. DTG installed

6. DTG turned over

7. DTG executed

8. DTG expected to be installed

9. Percent effective

10. Percent complete

11. DA 1355 on hand.

(C) Zone Progress Report (OBSREP-C): maintained by the division engineer and derived from OBSREP-B. It translates the specific data from OBSREP-B into an analysis of obstacle completion (by type) for each subsystem and groups subsystems into larger brigade systems. Each subsystem (zone) report has the following lines (as appropriate):

1. Zone

2. Minefield

    a. Planned

    b. Installed

3. Bridge

    a. Planned

    b. Installed

    c. Turned over

    d. Executed

4. Point

    a. Planned

    b. Installed

    c. Turned over

    d. Executed

5. Tank ditch

   a. Meters planned

   b. Meters complete

6. Percent effective

7. Percent complete

8. Projected DTG complete.

(D) Corps Obstacle Plan (OBSREP-D): maintained at corps level and derived from OBSREP-C. It is a tabular summary of obstacle subsystem completion across the corps, consisting of system/subsystem name, percentage complete, and projected DTG of completion. Each obstacle system or subsystem has the following three entries:

1. System or subsystem name

2. Percent complete

3. Projected DTG complete.

(E) OBSREP-E: maintained by brigade engineer and records the status of (1) enemy obstacles as they are encountered by friendly forces or (2) friendly obstacles that fall into enemy hands. Information includes:

1. Location

2. Old target number

3. Type

4. Minefield dimensions

5. Estimated time to clear

6. Coordinates: entry

7. Coordinates: exit

8. Mine type

9. Antihandling device.

**Engineer Report (ENGREP)**

This report is the engineer commander's assessment of the engineer situation in his/her area of responsibility. The report consists of four parts:

1. Assessment of the engineer situation: free text describing the commander's assessment of the past or next 24 hr of engineer activity.

2. Atomic demolitions munitions (ADM) site preparation: a formatted report giving the status of ADM drilling operations.

a. Number of operational ADM military construction teams.

b. Number of operational military drilling rigs.

c. Number of operational civilian drilling rigs.

d. Number of ADM shafts drilled to the desired depth by GDP option area and reference number to date.

3. Equipment status: formatted report giving the status of critical engineer equipment. Each subordinate unit reports the status of critical equipment to the brigade engineer. The brigade engineer produces a summary of these reports by type of equipment and unit. The report displays, for each type of equipment, the number on hand and the number fully mission-capable. The unit percentage fully mission-capable is shown for each type of equipment.

4. Engineer data sheet: gives critical information on the status of personnel, mobility, countermobility, and survivability assets. It can be expected to include any item considered critical to engineer operations. Each subordinate unit reports the following data items to the brigade engineer. The brigade engineer produces a summary report showing each subordinate's assets and the total.

a. Personnel resources--number of squads available and authorized.

b. Bridging resources (m)--

(1) Military load class 50+

(2) Wet support bridging on wheels

(3) Wet support bridging grounded

(4) Wet support bridging in use

(5) Dry support bridging on wheels

(6) Dry support bridging grounded

(7) Dry support bridging in use

(8) Assault bridging on launcher

(9) Assault bridging on transporter

(10) Assault bridging grounded

(11) Assault bridging in use.

c. Obstacle resources--

(1) Antitank mines (M15, M21, etc.)

(2) Explosives (C4, TNT, cratering, etc.).

d. Survivability resources--equipment by type (on-hand/authorized).

e. Class IV material--

(1) Concertina

(2) Minefield marking set.

**Engineer Mission Coordination Sheet (MISSREP)**

MISSREP is a formatted report which establishes a standard for coordinating engineer missions. It is designed to transfer specific details about an engineer mission between operational levels. Details include:

1. Mission number
2. Mission location
3. Mission type code
4. Mission priority
5. Start time required
6. Start time actual
7. Required completion time
8. Percent complete
9. Completion time actual
10. Critical equipment needed
11. Critical material needed
12. Remarks.

**Engineer Spot Report (ENGSPOTREP)**

ENGSPOTREP is a free text report that allows engineer commanders and their staffs to keep superiors fully informed of events having engineer operational importance.

**River Bridge Report**

This is a formatted operational report for coordinating tactical river-crossing missions. Information includes:

1. Bridge/raft type (code)
2. Location
3. DTG operational
4. Unit
5. Crossing unit
6. DTG first vehicle arrives at near-shore ERP
7. DTG last vehicle departs at near-shore ERP
8. Number of vehicles at near-shore ERP
9. DTG first vehicle arrives at crossing site
10. DTG first vehicle departs the crossing site
11. Number of vehicles to cross
12. DTG first vehicle arrives at far-shore ERP
13. DTG first vehicle departs the far-shore ERP
14. Number of vehicles at far-shore ERP.

## APPENDIX E:

## MCS DATA BASE MANAGEMENT CAPABILITIES*

The MCS DBMS is organized into four categories: friendly information, enemy information, operational environment, and mission-related information. The relational data base is constructed identically for each echelon.

The MCS DBMS contains the data elements required to support the four data categories. These data elements are supported by unique MCS message formats. In July 1987, the MCS message formats will be in accordance with the ACCS/MTF.

The unique information requirement at a specific node can be achieved by matching the necessary data element to the appropriate information category. In this way, the special requirements of each staff section can be achieved using an identical data base construction at all echelons and nodes.

The DBMS will allow search and retrieval of data from the data base by any information items or combinations thereof resident in the data base. Search and retrieval will be of two generic types: query and standing request for information (SRI).

The query provides for one-time data search and retrieval. The query can be local (retrieval from the local device) or remote (retrieval from the data base of any other device in the MCS network). Search and retrieval will be based on any combination of information items resident in the data base. In addition, a purge function will be provided via the query so that deletions can be made based on any search criterion or combinations thereof. The purge function will be restricted to the local data base only. The query will also provide a search and count of reports that would be generated upon a full search. This function enables the operator to determine, in advance, the length of the report(s) that would be generated, preventing unnecessary long print (local) or tranmission (remote) time.

The SRI provides the same search and retrieval capabilities as the query but automatically, without operator intervention. The criteria are stored in the device(s) of interest. Any data input to the device that meets the established criteria will generate a report to the subscriber who established them. Purges of the data base via the SRI will not be allowed. Within any MCS device, 10 SRIs are provided for any combination of local and remote SRI. Each SRI will be tagged with the time (DTG) at which it was established. Provisions will be made to delete, modify, or temporarily inhibit each established SRI.

The MCS data bases, although structured identically, will contain different information. The information contained in data bases of the various MCS devices will be based on the Commander's Critical Information Requirement (CCIR). The entire CCIR will be maintained by each primary command post at each echelon. Within each command post, however, the CCIR can be distributed among several MCS devices. Appendix F lists storage sites for engineer CCIRs.

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*This appendix is taken from the *Operational and Organizational Plan for the Maneuver Control System*, Vol 1 (Draft) (CACDA, May 1985), and describes the MCS data base management system (DBMS). The DBMS provides a way to manage data to provide the commander/staff with timely and accurate information.

## APPENDIX F:

## MCS STORAGE LOCATIONS OF ENGINEER CCIR ITEMS

The following lists of CCIRs are physically stored at engineer brigade, engineer battalion, ACR engineer, and brigade engineer levels.

### Engineer Brigade Operations

1. Corps priority intelligence requirements (PIR)
2. Enemy OMG objectives
3. Enemy OMG locations
4. Enemy division objectives
5. Enemy division locations
6. Enemy regiment objectives
7. Enemy regiment locations
8. Enemy courses of action
9. Enemy probable course of action
10. Location/time enemy main attack
11. Location/time enemy support attack
12. Enemy airborne/airmobile capabilities
13. Enemy probability of using NBC weapons
14. 48-hour weather forecast
15. Weather impact on CBT operations
16. Area of operation trafficability analysis
17. Condition of water obstacles in area of operations
18. Anticipated changes in water obstacles
19. Corps supporting units mission
20. ADA unit priority of supply point FOR
21. Enemy air employment technique
22. Corps task organization
23. Mission of corps
24. Mission of corps major subordinate commands (MSC)
25. Current activity of MSC
26. Location of corps MSC, main, TAC and rear CPS
27. Corps FLOT
28. NBC status of corps
29. NBC status of corps MSC
30. Corps reserves location
31. Nuclear/chemical release policy
32. Operational graphics and control measures
33. Main/secondary supply route location/status
34. Bridging/fording sites in corps sector
35. Enemy avenues of approach into corps sector
36. Corps axes of advance into enemy sector
37. Key terrain in corps sector
38. Corps obstacles/barrier plan
39. NBC contaminated areas in corps sector
40. POW collection point location/status
41. Corps engineer unit location/status
42. Bridging capability of corps engineers
43. Obstacle breaching capability of corps engineers

44. Ditching capability of corps engineers
45. Mining capability of corps engineers
46. Corps medical facilities status location
47. Location of corps artillery units
48. Corps artillery organization for combat (DS, GS, GSR)
49. Corps artillery unit priority of fires
50. EAC mission
51. EAC CDR intent/scheme
52. EAC priority of effort
53. Corps scheme of maneuver
54. Corps priority of fire
55. Corps commander concept of operation
56. Corps command coordinating instructions.

**Engineer Battalion Operations**

1. Division priority intelligence requirements (PIR)
2. Enemy division objectives
3. Enemy division locations
4. Enemy regiment objectives
5. Enemy regiment locations
6. Enemy battalion objectives
7. Enemy battalion locations
8. Enemy probable course of action
9. Location/time enemy main attack
10. Location/time enemy support attack
11. Enemy airborne/airmobile capabilities
12. Enemy probability of using NBC weapons
13. 48-hour weather forecast
14. Area of operation trafficability analysis
15. Condition of water obstacles in area of operations
16. Anticipated changes in water obstacles
17. Division supporting units mission
18. Priority of supply point for ADA units
19. Enemy air employment technique
20. Division task organization
21. Mission of division
22. Mission of division major subordinate commands (MSC)
23. Current activity of MSC
24. Location of division MSC, main, TAC and rear CPS
25. Division FLOT
26. NBC status of division
27. NBC status of division MSC
28. Division reserves location
29. Nuclear/chemical deliver system status
30. Nuclear/chemical munition status
31. Nuclear/chemical release policy
32. Operational graphics and control measures
33. Main/secondary supply route location/status
34. Bridging/fording sites in division sector
35. Enemy avenues of approach into division sector
36. Division axes of advance into enemy sector
37. Key terrain in division sector

38. Division obstacles/barrier plan
39. NBC contaminated areas in division sector
40. POW collection point location/status
41. Division engineer unit location/status
42. Bridging capability of division engineers
43. Obstacle breaching capability of division engineers
44. Ditching capability of division engineers
45. Mining capability of division engineers
46. Division medical facilities status location
47. Medical facilities of division MSC status/location
48. Location of division artillery units
49. Division artillery organization for combat (DS, GS, GSR)
50. Division artillery unit priority of fires
51. Corps mission
52. Corps CDR intent/scheme
53. Corps priority of effort
54. Division scheme of maneuver
55. Division priority of fire
56. Division target criteria
57. Division commander concept of operation
58. Division command coordinating instructions.

**Armored Calvalry Regiment (ACR) Engineer**

1. ACR priority intelligence requirements (PIR)
2. Enemy regiment objectives
3. Enemy regiment locations
4. Enemy battalion objectives
5. Enemy battalion locations
6. Enemy company objectives
7. Enemy probable course of action
8. Location/time enemy main attack
9. Location/time enemy support attack
10. Enemy airborne/airmobile capabilities
11. Enemy probability of using NBC weapons
12. 48-hour weather forecast
13. Weather impact on CBT operations
14. Area of operation trafficability analysis
15. Condition of water obstacles in area of operations
16. Anticipated changes in water obstacles
17. ACR adjacent unit locations
18. ACR adjacent unit task organization
19. ACR adjacent unit activity
20. ACR supporting unit's mission
21. ACR supporting unit organization
22. Priority of supply point for ADA units
23. Enemy air employment technique
24. ACR task organization
25. Mission of ACR
26. Mission of ACR units
27. Current activity of ACR units
28. Center of mass of ACR units
29. Location of main and TAC CPS of ACR units

30. ACR FLOT
31. Status of ACR battle resources
32. NBC status of ACR
33. NBC status of ACR units
34. ACR reserves location
35. ACR reserves mission
36. Nuclear/chemical delivery system status
37. Nuclear/chemical munition status
38. Nuclear/chemical release policy
39. Operational graphics and control measures
40. Main/secondary supply route location/status
41. Bridging/fording sites in ACR sector
42. Enemy avenues of approach into ACR sector
43. ACR axes of advance into enemy sector
44. Enemy rotary aircraft attack routes
45. Key terrain in ACR sector
46. ACR obstacles/barrier plan
47. NBC contaminated areas in ACR sector
48. POW collection point location/status
49. ACR engineer unit location/status
50. Bridging capability of ACR engineers
51. Obstacle breaching capability of ACR engineers
52. Ditching capability of ACR engineers
53. Mining capability of ACR engineers
54. Priority for personnel replacements
55. ACR medical status
56. ACR medical facilities status location
57. Medical facilities of ACR unit status/location
58. Location of ACR artillery units
59. ACR artillery organization for combat (DS, GS, GSR)
60. ACR artillery unit priority of fires
61. Corps mission
62. Corps CDR intent/scheme
63. Corps priority of effort
64. ACR scheme of maneuver
65. ACR priority of fire
66. ACR target criteria
67. ACR commander concept of operation
68. ACR command coordinating instructions.

**Brigade Engineer**

1. Brigade priority intelligence requirements (PIR)
2. Enemy regiment objectives
3. Enemy regiment locations
4. Enemy battalion objectives
5. Enemy battlion locations
6. Enemy company objectives
7. Enemy company locations
8. Enemy probable course of action
9. Location/time enemy main attack
10. Location/time enemy support attack
11. Enemy artillery capabilities

12. Enemy close air support
13. Enemy airborne/airmobile capabilities
14. Enemy probability of using NBC weapons
15. 48-hour weather forecast
16. Weather impact on CBT operations
17. Area of operation trafficability analysis
18. Condition of water obstacles in area of operations
19. Anticipated changes in water obstacles
20. Brigade adjacent unit locations
21. Brigade adjacent unit task organization
22. Brigade supporting units mission
23. Brigade supporting unit organization
24. Priority of supply point for DS ADA units
25. Enemy air employment technique
26. Brigade tank organization
27. Mission of brigade
28. Mission of brigade units
29. Current activity of brigade units
30. Center of mass of brigade units (two echelons down)
31. Location of main and TAC, and rear CPS of brigade units
32. Brigade FLOT
33. Status of brigade battle resources
34. Status of brigade unit battle resources
35. NBC status of brigade
36. Brigade reserves location
37. Nuclear/chemical delivery system status
38. Nuclear/chemical munition status
39. Nuclear/chemical release policy
40. Operational graphics and control measures
41. Main/secondary supply route location/status
42. Bridging/fording sites in brigade sector
43. Enemy avenues of approach into brigade sector
44. Brigade axes of advance into enemy sector
45. Enemy high performance aircraft attack route
46. Enemy rotary aircraft attack routes
47. Key terrain in brigade sector
48. Brigade obstacles/barrier plan
49. NBC contaminated areas in brigade sector
50. POW collection point location/status
51. Brigade DS engineer unit location/status
52. Bridging capability of brigade DS engineers
53. Obstacle breaching capability of brigade DS engineers
54. Ditching capability of brigade DS engineers
55. Mining capability of brigade DS engineers
56. Brigade medical facilities status/location
57. Medical facilities of brigade MSC status/location
58. Location of brigade DS artillery units
59. Brigade DS artillery organization for combat (DS, GS, GSR)
60. Brigade DS artillery unit priority of fires
61. Division mission
62. Division CDR intent/scheme
63. Division priority of effort
64. Brigade scheme of maneuver
65. Brigade priority of fire

66. Brigade target criteria
67. Brigade commander concept of operation
68. Brigade command coordinating instructions.

## APPENDIX G:

## ENGINEER BATTALION THROUGH PLATOON REPORTS

This appendix is based on USAES's response to CAC's request to review standard reports for engineer applicability. USAES has divided the reports into five categories depending on unit mission: general, mobility, countermobility, survivability, and general engineering; engineer reports that better represent engineer activities have been added.

### General

These reports will be used as they occur during day-to-day operations at all engineer units. Included under this type of report are all administrative/logistic, personnel, and nonengineer-specific operation reports:

A023 - Enemy Contact Report
A026 - Enemy Situation Report
A027 - Enemy Crossing and Barrier Report
A063 - Engr Data Sheet Update
A064 - FLOT
A423 - Order Message
A828 - Road Movement
B260 - Friendly Unit Situation
B925 - Enemy POW
C110 - Intell Report
C130 - Mission Report
C400 - Cdr's SITREP
C443 - NBC 3
C447 - NBC 4
C460 - Communications Spot Report
C488 - NBC 1
C501 - NBC 5
C503 - Effective Downwind Message
C505 - Friendly Nuclear Strike Warning
C506 - NBC 6
C507 - Chemical Downwind Message
C522 - Weather Report
C523 - Severe Weather Warning
C802 - Logistics SITREP
C929 - SIR
D210 - Fire Mission--Call for Fire
D942 - Topo Spot Report
G130 - Daily Intell Summary
G489 - NBC 2
S004 - Assets Available
S005 - Battle Losses
S006 - Casualty Info
S009 - Critical Situation Report
S010 - Enemy Activity
S011 - Enemy Weapons Systems
S013 - Basic Load Percentage Fill
S015 - EEI Report

S026 - POL Locations
S031 - USR
S034 - Supply Shortages
S035 - Required Supply Rate
M014 - Assets Available
M019 - Basic Load Percent Fill
M020 - Battle Losses (Equip)
M024 - Call for Fire
M025 - Casualty Report
M040 - EN Aircraft
M042 - EN Situation/Assessment
M051 - Intell Summary
M056 - MIJI
M057 - NBC Report
M060 - POL Locations
M062 - Priority of Issue
M065 - Radiation Dose Status
M074 - SITREP
M081 - Task Organization.

**Mobility**

Engineer communicators will use these reports to relay information dealing with mobility-type operations, including minefield, bridging, rafting statuses, and mobility reconnaissances.

*Standard Reports*

A062 - Minefield Report
C440m- Minefield Operations
C923 - Recon Results
S012 - Ford/Bridging Sites
S020 - Engineer Support Required
M023 - Bridging
M053 - Minefields.

*Engineer Specific Reports*

Route Reconnaissance. An engineer squad(s) conducts specific route reconnaissance. The results provide the engineer company with information needed for mobility and countermobility operations. Required trafficability information such as road width, grade, and obstructions is used by the engineer company and elements of the supported maneuver unit in planning their operations.

River Reconnaissance. The results of this reconnaissance provide the engineer company with needed information (e.g., current speed, water depth, length of gap) for mobility and countermobility operations. The engineer company analyzes this information and provides recommendations on river-crossing operations to the supported maneuver unit.

Obstacle Reconnaissance. Reconnaissance results provide the engineer company with information needed for mobility operations. The engineer leadership evaluates information provided by the reconnaissance (e.g., obstacle type, size, depth) and plans for breaching operations.

Bridge/Fording Reconnaissance. An engineer squad(s) conducts a bridge/ford reconnaissance to determine the military load class and to find fording sites. This information is then passed to the engineer company, which provides recommendations on river-crossing operations to the supported units.

Tunnel Reconnaissance. Reconnaissance provides information on storage capacity and trafficability of tunnels.

**Countermobility**

Engineer leaders use these reports to relay information about countermobility operations such as obstacle data and minefield employment.

*Standard Reports*

A062 - Minefield Report
C923 - Recon Results
C440m- Minefield Operations
S018 - Joint Minefield Operations
S025 - Barriers/Obstacles
S028 - Engr Support Required.

*Engineer Specific Reports*

The Target Status report provides information on obstacle systems, including target location, type, priority, and status (limited, installed, turned over, executed). It is normally used at battalion and company levels.

**Survivability**

Engineer units use these reports to provide information to commanders on the status of survivability missions being performed by engineer units.

*Standard Reports*

C923 - Recon Results
S028 - Engineer Support Required.

*Engineer Specific Reports*

Fortification Construction report provides information on the construction of survivability positions to reduce enemy weapon system effectiveness. It includes the fortification/survivability position type, location, priority, and status of completion (initiated, installed). Normally utilized at battalion and company level.

**General Engineering**

Engineer leaders use these reports to relay information about general engineering operations such as construction requests and general reconnaissance missions.

*Standard Reports*

C923 - Recon Results
S028 - Engr Support Required
D941 - Construction Assistance Requests
F940 - Engr Construction Situation
S020 - Roads.

*Engineer Specific Reports*

Engineer Resource Recon. An engineer squad/platoon identifies locations of engineer resources such as sand, gravel, and lumber through reconnaissance.

Construction Site Recon. Relays information to the engineer company on site for future construction missions such as fortifications, horizontal and vertical structures, culverts.

General Engineer Recon. Relays information on reconnaissance performed to gain information about general engineering activities such as water point, airfield, and tunnel/bypass locations.

Road Maintenance. Relays information about engineer elements performing haul-and-fill operations in support of road construction and maintenance in the division, corps, and theater rear areas.

## APPENDIX H:

## ENGINEER TASK/RESOURCE DATA BASE

### Mobility Tasks

1. Repair and maintain MSR (two-lane bituminous)
2. Repair and maintain unpaved secondary road (two-lane)
3. Repair and maintain unpaved combat road (one-lane)
4. Construct unpaved secondary road (Class C)
5. Construct combat trail
6. Reduce dry gap for vehicle passage
7. Construct temporary ford site
8. Conduct hasty assault minefield breach
9. Breach antitank ditch
10. Breach road crater
11. Breach abatis
12. Breach wire obstacle
13. Breach roadblock
14. Assault crossing with AVLB (0 to 17 m Class 60).

### Countermobility Tasks

1. RCD - deliberate road crater
2. RCH - hasty road crater
3. RCM - road crater with M-180
4. RCR - relieved face road crater
5. BRA - blow major four-lane highway bridge
6. BRB - blow primary highway bridge
7. BRC - blow secondary two-lane highway bridge
8. ABT - abatis
9. ATD - antitank ditch
10. WBT - general purpose barbed-tape obstacle
11. WTC - triple standard concertaina
12. WRC - nonstandard concertina roadblock
13. MFAT - RAAMS artillery delivered AT minefield
14. MFAP - ADAM artillery delivered AP minefield
15. MFGT - minefield, GEMSS, AT only
16. MFGP - minefield, GEMSS, AP only
17. MFGM - minefield, GEMSS, mixed AT and AP
18. MFMT - minefield, MOPMS, AT
19. MFMP - minefield, MOPMS, AP
20. MFH - M56 helicopter delivered AT mines
21. MFAF - GATOR, USAF delivered scatterable mines
22. MFD - M57 AT mine dispensing system
23. MFJ - standard minefield, density 0.5-0.5-0
24. MFK - standard minefield, density 1-1-1.

**Survivability Tasks**

1. Protective Position, APC/M2 Bradley
2. Protective Position, TANK
3. Protective Position, VULCAN (Towed)
4. Protective Position, 105MM Towed
5. Protective Position, 155MM Towed
6. Protective Position, 8-INCH/155-MM SP
7. Protective Position, ARTY Ammo Carrier
8. Protective Position, Noncombat Vehicle
9. Protective Position, CP Carrier
10. Berm For CHAPARRAL
11. Berm For FAAR
12. Berm For CB/CM Radar (FA)
13. Berm For HAWK Launcher
14. Berm For Info Coordination Center (HAWK)
15. Berm For PAR/ROR/CWAR/HIPIR (HAWK)
16. Berm For Generator (HAWK)
17. Cut Slot Ror Battery Control (HAWK)
18. Cut Slot For PLT CP (HAWK)
19. Construct Vehicle Trench (Communications)
20. Construct Shelters For Command & Commo Facilities

**Reconnaissance Tasks**

1. Route
2. Road
3. Bridge
4. Special
5. Engineer

**Resources Tracked for Initial Estimate**

1. Combat engineer squad hours
2. Blade hours
3. GEMSS hours
4. M-57 minelayer hours
5. M-56 helicopter sorties
6. Artillery rounds--AT
7. Artillery rounds--AP
8. GATOR canisters
9. Total logistic weight (MT).

**Resources Tracked For Detailed Estimate**

1. Manpower:

    - Combat engineer squads (hr)

2. Logistics:

- Expendibles (nonexplosive)

  - Aluminum shelter kit (each)
  - Asphalt (gal)
  - Barbed tape (reels)
  - Barbed tape concertina (coils)
  - Culvert (m diameter)
  - General purpose barbed-type obstacle (GPBTO) packages (each)
  - Long pickets (each)
  - Short pickets (each)

- Expendibles (explosive)

  - C-4 (kg)
  - CEV rounds (each)
  - Cratering charges (18-kg/40-lb) (each)
  - Detonating cord (m)
  - Electric blasting caps (each)
  - Fuse lighters (each)
  - M-14 APB mines (each)
  - M-15 AT mines (each)
  - M-16 APF mines (each)
  - M-21 AT mines (each)
  - M180 kits (each)
  - M173 kits (each)
  - M1A1 bangalore torpedos (each)
  - Nonelectric blasting caps (each)
  - M3 shaped charges (18-kg/40-lb) (each)
  - MICLIC M58A3 line charge, MK22 rocket (each)
  - SLUFAE rockets (each)
  - Time fuse (m)
  - TNT (kg)
  - XM-74 AP mines (each)
  - XM-75 AT mines (each)
  - XM-131 MOPMS AP packs (each)
  - XM-132 MOPMS AT packs (each)

3. Equipment:

- 2.5-Cu yd scoop loader (hr)
- 2.5-Ton truck (hr)
- 5-Ton dump truck (hr)
- 5-Ton truck (hr)
- 10-Ton steel-wheeled roller (hr)
- M916 tractor (hr)
- 13-Wheel (towed) roller (hr)
- Armored combat earth mover (ACE) (hr)
- Air compressor (hr)
- JD410/Auger (hr)
- Armored vehicle-launched bridge (AVLB) (hr)
- Bitum kettle (hr)
- Combat engineer vehicle (CEV) (hr)

- Crane (hr)
- T-5 dozer (hr)
- D-7 dozer (hr)
- D-8 dozer (hr)
- Ground-emplaced mine-scattering system (GEMSS) (hr)
- Graders (hr)
- M-57 antitank mine dispensing system (hr)
- MK122 MICLIC launcher (hr)
- Scraper (hr)
- Small emplacement excavator (SEE) (hr)
- Truck-mounted water distributor (hr)
- Vibratory roller (hr)
- Water distributor (towed) (hr).

4. Nonengineer resources:

   - AP - artillery rounds (each)
   - AT - artillery rounds (each)
   - GATOR canisters (each)
   - M56 helicopter sorties (each).

## APPENDIX I:

## MCS-NDI DECISION SUPPORT GRAPHICS CAPABILITIES

### Level I Operations

The following elements will be displayed as overlays on a map image:

1. Control measures--

   - Unit boundaries
   - Phase lines
   - FLOT
   - Axes of advance
   - Avenues of approach.

2. Friendly units: location and status (Green, Amber, Red)--

   - Corps main CP
   - Corps TAC CP
   - Corps rear CP
   - Sep Bde/ACR main CP
   - Sep Bde/ACR TAC CP
   - Div main CP
   - Div TAC CP
   - Div Bde main CP
   - Div Bde TAC CP.

3. Enemy units: location and status.

### Level II Operations

These operations are the same as for the Level I situation two echelons down and one echelon up.

### Level III Operations

This level will contain the same information as Levels I and II, except that the user can add or delete the following information:

1. Friendly/enemy units--

   - Type
   - Size.

2. Fire support--

   - FA units
   - Fire support plan

- Targets within an area
- Priority targets
- Final protective fires.

3. ADA--

   - ADA units
   - ADA weapons.

4. Aviation--

   - Aviation units
   - Friendly/enemy helicopter attack routes
   - Friendly/enemy fast-mover attack routes.

5. Engineer--

   - Engineer units
   - Obstacle plan
   - Point targets
   - Area targets
   - Targets emplaced
   - Targets executed
   - Targets prepared
   - Targets turned over
   - Targets breached.

6. NBC--

   - NBC units
   - Contaminated areas
   - Vulnerability assessments
   - Decontamination sites
   - Possible decontamination sites
   - Fallout predictions.

7. Logistical activities--

   - MSR condition/status
   - Ammunition supply points
   - Ammunition transfer points
   - Maintenance collection points
   - Maintenance salvage points
   - Clothing exchange and bath points
   - Graves registration points
   - Water points
   - Medical facilities.

**Battle Resources**

Level I will display the following six resources by unit in a pie chart. The pie chart will use green, amber, and red colors as condition and status indicators.

1. Pacing items--

   - Top five systems the commander wishes to track.

2. Support systems--

   - Top five systems the commander wishes to track.

3. Personnel--

   - Officers
   - Warrant officers
   - Enlisted
   - Critical MOS.

4. Class V--

   - Top five types of ammunition the commander wishes to track.

5. C3 system--

   - C2 systems
   - Communications
   - C2 vehicles.

6. Other information displayed--

   - Combat effectiveness
   - Unit radiation status level
   - Unit MOPP level
   - Unit mission
   - Unit task organization
   - CP locations.

Level II displays the same battle resources information as Level I, but for an organization's subordinate units. Battle resources can be displayed two echelons down.

Level III displays battle resources by type in tabular format (e.g., Class I, III, V, IX, water, weapon systems, engineer systems).

**Intelligence**

Level I shows avenues of approach into an organization's area of influence. Level II provides detailed information on a specific avenue of approach into an organization's area of influence, and Level III provides details on a projected future specific avenue of approach.

## LIST OF ABBREVIATIONS

| | |
|---|---|
| A/A | Avenues of approach/axes of advance |
| AC | Analyst console |
| AC2MP | Army Command and Control Master Plan |
| ACCS | Army Command and Control System |
| ACE | Assistant Corps Engineer |
| ACEOPS | Automated Combat Engineer Operations and Planning System |
| ACR | Armored Cavalry Regiment |
| ADA | Air defense artillery |
| ADCCS | Air Defense Command and Control System |
| ADE | Assistant division engineer |
| ADM | Atomic demolitions munitions |
| AFATDS | Advanced Field Artillery Tactical Data System |
| ASAS | All Source Analysis System |
| ASCII | American Standard Code for Information Interchange |
| Bde | Brigade |
| Bn | Battalion |
| BT | Battalion terminal |
| CAC | Combined Arms Center, Fort Leavenworth, KS |
| CACDA | Combined Arms Combat Development Activity |
| Cbt | Combat |
| CCIR | Commander's Critical Information Requirements |
| CCSS | Command and Control Subordinate System |
| CDR | Commander |
| CEM3 | Combat Engineer Mission Management Module |
| CFA | Corps forward area |
| CP | Command post |
| CSSCS | Combat Service Support Control System |
| DBMS | Data base management system |
| DCA | Department of Combined Arms |
| DCD | Directorate of Combat Developments |
| DCT | Digital communications terminal |
| Div | Division |
| DME | Department of Military Engineering |
| DOTD | Directorate of Training and Doctrine |
| DS | Direct support |
| DTG | Date-time group |
| EAC | Echelons above corps |
| ECCS | Engineer Command and Control System |
| ENCAMP | Engineer Command and Control Automation Master Plan |
| Engr | Engineer |
| ENGREP | Engineer report |
| ENGSPOTREP | Engineer spot report |
| ERP | Engineer regulating point |
| FLIRP | Force Level Information Requirement Plan |
| FLOT | Forward line of troops |
| GDP | General defense plan |
| GS | General support |
| Hvy | Heavy |
| JINTACS | Joint Interoperability of Tactical Command and Control Systems |
| LED | Light-emitting diode |
| MCS | Maneuver Control System |

| | |
|---|---|
| MCS-NDI | Maneuver Control System-nondevelopment item |
| MISSREP | Engineer mission coordination sheet |
| MOPP | Mission oriented protective posture |
| MSC | Major subordinate commands |
| MSR | Major supply route |
| NATO | North Atlantic Treaty Organization |
| NBC | Nuclear, biological, chemical |
| OBSREP-A | Obstacle progress report |
| OBSREP-B | Belt progress report |
| OBSREP-C | Zone progress report |
| OBSREP-D | Corps obstacle plan report |
| OBSREP-E | Enemy obstacle report |
| OOP | Operational and organization plan |
| Ops | Operations |
| PIR | Priority intelligence requirements |
| PJH | Position Location Reporting System and Joint Tactical Information Distribution System Hybrid |
| POL | Petroleum oil lubricants |
| POM | Program objective memorandum |
| POW | Prisoner of war |
| RAM | Random access memory |
| RBA | Rear brigade area |
| ROM | Read-only memory |
| SITREP | Situation report |
| SOP | Standard operating procedure |
| SRI | Standing request for information |
| STANAG | NATO Standardization Agreement |
| TAC | Tactical command post |
| TCP | Tactical computer processor |
| TCS | Tactical computer system |
| TCT | Tactical computer terminal |
| TOC | Tactical operations center |
| USA-CERL | U.S. Army Construction Engineering Research Laboratory |
| USAES | U.S. Army Engineer School |
| USAESC | U.S. Army Engineer Studies Center |

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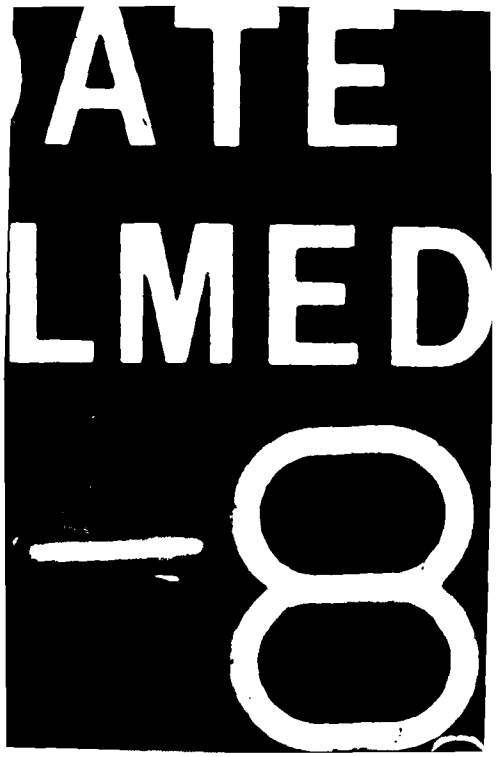
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